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Winter Injury

Besides the several types of injury caused by winter conditions in fruit, vegetables and tender foliage, there are seven distinct types which affect the woody tissues of trees and shrubs. These may be summed up as follows:

1. **Injury due to extreme and long continued low temperature.** This is equivalent to growth of a plant out of its normal range and the low temperature alone kills bugs, twigs or the whole tree.

2. **Injury from winter** sometimes occurs because of immaturity of tissues in autumn. Owing to drought, defoliation by insects or disease, or other causes, growth may stop long before the normal period, and if more favorable conditions return the tree enters on a period of second growth. Second growth of this kind may occur over the whole tree or on certain parts of it. When growth is thus resumed, it has to go through almost the whole seasonal cycle and if the period is too short for this, the tissues enter the winter in an immature condition, in which case they are readily killed by even a moderate frost. Since secondary growth of this kind is greatest about buds and twigs these parts suffer most, and the extent of the injury will be determined by the vigor of the second growth period and the degree to which it was able to complete its growth cycle before freezing took place.

Injuries arising from this cause usually have clearly marked symptoms; the second growth is readily noted on the twigs, either by difference in size or in the distance between the buds, or in the size and maturity of the buds; the buds on the second growth portion usually are incompletely formed and often no terminal bud is present; further, the wood of such twigs shows two more or less distinct annual rings near the base of the current year's twig. The comparative size of the two rings will vary according to the time when midseason dormancy was attained. The outer ring may be well marked or it may be merely a thin layer of tissue, in which case it is undoubted evidence of immaturity.

The reference of this type of winter injury to its proper cause is often helped by noting its relation to the rest of the tree. In fruit trees at least, and doubtless in other trees, the buds mature first then the twigs and limbs and trunk and roots in order. The extent to which killing back occurs ought to be roughly parallel to the extent of second growth and maturity of the same when the season ended.

It sometimes happens that fruit trees are only mature in autumn and are caught by an early frost. In such cases the buds and the limbs may be mature, but the trunk and sometimes merely the crotches of main limbs are still immature and are killed. This does not often happen in native trees and shrubs.

3. **Root injury** in fruit trees from winter is usually attributed to (a) a hard, earthy soil which freezes deeply; (b) a tender rootstock; (c) removal of surface earth from the tender stock by erosion or plowing or to remove borers. Injuries of this kind are not usual in native trees.

4. **Sunscald** is a common form of winter injury in fruit trees and is quite common on shade trees, but rare on wild plants. It arises from the heating action of the sun in late winter. The heat thus generated in the trunk or main limbs starts the cambium out of its dormant condition and even a moderate freeze thereafter will destroy the active tissue. Trees on sheltered city streets exposed to the sun often suffer in this way. In all these cases the affected areas are on the south or southwest sides, which differentiates this type of injury from that mentioned in (2) which has no such orientation.

5. **Another type of scald** due to winter is attributed to the action of warm drying air on the top while the roots are still frozen so thoroughly and so deeply that no water can be supplied to replace evaporation loss. This is a type common on conifers and particularly on pines.

6. **A very common type** of winter killing is allied to the sunscald mentioned in (4). In this case the buds are stimulated by warm weather into growth in late winter and a succeeding frost kills them and the twigs, depending on the extent to which stimulation occurred. It is to be noted here that the buds are first to start into growth, then the twigs, and the general awakening proceeds down the tree in the same order as it entered dormancy. This does not seem to agree with the cases mentioned in (4) but in the case of tree trunks it must be remembered that the large surface absorbs and retains heat readily while in the twigs and buds the heat is dissipated into the air too readily for stimulation to occur.

7. **A late frost in spring** often causes a peculiar type of damage quite apart from the common destruction of blossoms or twigs which have been well started on their seasonal growth. When the frost is not severe and the tissues are water filled, ice is formed and though the cold does not actually destroy the life of the cells, the expansive action of ice bursts and crushes the tissues, leaving all sorts of cracks, blisters and internal wounds. Barring infection, these heal up later as any wound will do and little permanent damage results.